## Antimicrobial Stewardship

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Hosted by Jane Barnett jane@webbertraining.com





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## Objectives

- \* Appreciate the immediate threat of antimicrobial resistance and the importance of antimicrobial stewardship
- \* Outline the main principles for good stewardship of antimicrobials
- \* Describe practical strategies and activities that form the basis of a hospital's antimicrobial stewardship program
- \* Formulate an antimicrobial stewardship implementation plan for healthcare facilities

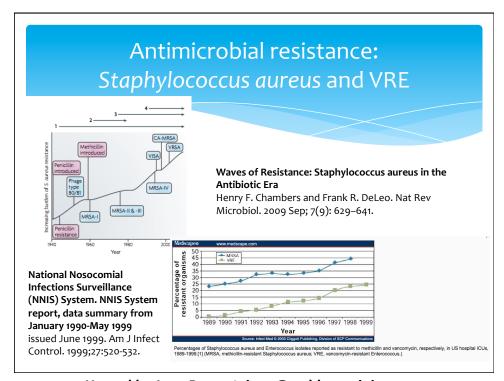
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#### Antimicrobial resistance

- WHO has identified antimicrobial resistance to be one of five major global threats to mankind
- 1. Microbial resistance to current antimicrobial artillery is growing at an alarming rate: MRSA, VRE, CREs
- 2. Dwindling novel antimicrobial agents in the development pipeline

World Health Organization. The Evolving Threat of Antimicrobial Resistance: Options for Action.; 2012.

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#### Antimicrobial resistance: Carbapenem resistant Enterobacteriaceae

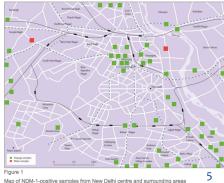


Gram-negative resistance: can we combat the coming of a new "Red Plague"?

Coordinated action is urgently needed to tackle a looming public health crisis

David F M Looke, Thomas Gottlieb, Cheryl A Jones and David L Paterson. Med J Aust 2013; 198 (5): 243-244.

Dissemination of NDM-1 positive bacteria in the New Delhi environment and its implications for human health: an environmental point prevalence study. Walsh TR, Weeks J, Livermore DM, Toleman MA. Lancet Infect Dis. 2011 May;11(5):355-62.



Carba-resistant Carba-susceptible Risk Ratio Risk Ratio Study or Subgroup 1.1.1 Bacteremia Total Total Weight M-H, Random, 95% CI M-H, Random, 95% CI 2.30 [1.68, 3.16] Ben-David 2012 34 43 148 Chang 2011 Daikos 2007 Daikos 2009 1.88 [1.32, 2.69] 4.63 [1.76, 12.16] 2.54 [1.26, 5.12] 1.65 [0.95, 2.86] 17.3% 6.0% 9.3% 12.2% 37 Mouloudi 2010 22 Patel 2008 Subtotal (95% CI) 48 14.9% 78.1% 2.19 [1.82, 2.63] 222 Total events Heterogeneity: Tau<sup>2</sup> = 0.00; Chi<sup>2</sup> = 4.53, df = 5 (P = 0.48); I<sup>2</sup> = 0% Test for overall effect: Z = 8.30 (P < 0.00001) 1.1.2 Bacteremia or other infections Falagas 2007 0.89 [0.51, 1.55] 16 Gaviria 2011 1.4% 0.67 (0.07, 5.99) Schwaber 2008 Subtotal (95% CI) 3.50 [1.63, 7.51] 1.46 [0.47, 4.49] 8.4% 21.9% Total events Heterogeneity: Tau<sup>2</sup> = 0.68; Chi<sup>2</sup> = 8.68, df = 2 (P = 0.01); I<sup>2</sup> = 77% Test for overall effect: Z = 0.65 (P = 0.51) 2.05 [1.56, 2.69] Total events 149

Technical Appendix Figure. Death risk ratios (RRs) for patients infected with carbapenem-resistant Enterobacteriaceae (CRE) versus carbapenem-susceptible Enterobacteriaceae (CSE). Vertical line represents the point of no difference between carbapenem-resistant and carbapenem-susceptible pathogens; squares represent RRs; diamonds represent pooled RRs for all studies; horizontal lines represent 95% CIs. RRs were determined by using a Mantel-Haenszel (M-H) random effects model. Carba-resistant, CRE; Carba-susceptible, CSE. References: Ben-David 2012 (1); Chang 2011 (2); Daikos 2007 (8); Daikos 2009 (5); Mouloudi 2010 (4); Patel 2008 (6); Falagas 2007 (9); Gaviria 2011 (3); Schwaber 2008 (7).

#### Deaths Attributable to Carbapenem-Resistant Enterobacteriaceae Infections

Matthew E. Falagas, Giannoula S. Tansarli, Drosos E. Karageorgopoulos, and Konstantinos Z. Vardakas. 6 Emerg Infect Dis. 2014 Jul; 20(7): 1170–1175.

## **Antimicrobial Stewardship**

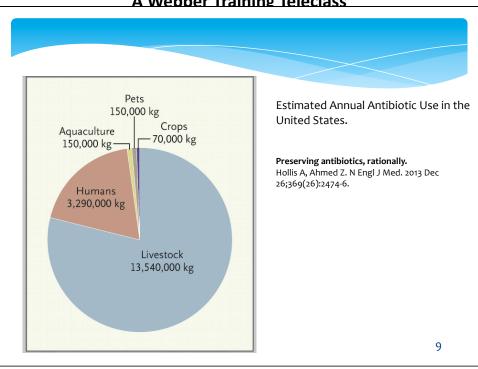
- \* Antimicrobial Stewardship (AMS) term coined in 1997 "help optimise therapy;
  - ensuring the best clinical outcome for the patient (right choice of antibiotic at the right dose)
  - while endeavouring to lower the risk of subsequent development of antimicrobial resistance"

Society for Healthcare Epidemiology of America and Infectious Diseases Society of America Joint Committee on the Prevention of Antimicrobial Resistance: guidelines for the prevention of antimicrobial resistance in hospitals. Shlaes DM, Gerding DN, John JF, et al. Clin Infect Dis. 1997;25(3):584-99.

## **Antimicrobial Stewardship**

\*Simple definition, however --> complex and broad issue

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#### Antimicrobial Stewardship in Hospitals

\* Hospitals: up to 59% of patients are prescribed antimicrobials at any one time.

The European surveillance of antimicrobial consumption (ESAC) point-prevalence survey of antibacterial use in 20 European hospitals in 2006. Ansari F, Erntell M, Goossens H, Davey P. Clin Infect Dis 2009; 49: 1496–504.

\* Studies in the hospital setting estimate that up to 40% of these drugs may be inappropriate.

Antimicrobial stewardship. Fishman, N Am J Med 2006; 119: S53–61; discussion S62.

10

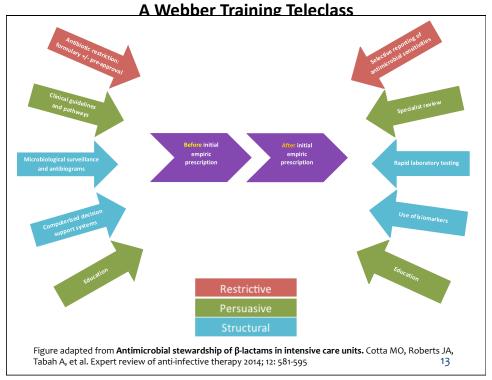
#### Antimicrobial Stewardship in Hospitals Table 2 Appropriateness of treatment and surgical antibiotic prophylaxis (SAP) prescriptions Treatment prescriptions Total (n = 683)Range (%) n (%) Treatment prescriptions 549 (80.4) (68.2 - 95.2)assessed as appropriate Using periodic point-prevalence surveys to assess (6.0–27.3) appropriateness of antimicrobial prescribing in assessed as inappropriate Australian private hospitals. Treatment prescriptions that 35 (5.1) Cotta MO, Robertson MS, Upjohn LM, Marshall C, Liew D, Buising KL. Intern Med J. 2014 Mar;44(3): could not be assessed 240-6. SAP prescriptions Total (n = 471)n (%) Range (%) 191 (40.6) (23.5-100)SAP prescriptions assessed as appropriate 204 (43.3) SAP prescriptions where (8.3-100)indication was documented 11

## Principles of AMS

Therapeutic Guidelines: Antibiotic (Antibiotic Expert Group 2006)

- M Microbiology guides therapy wherever possible
- Indications should be evidence based
- N Narrowest spectrum required
- Dosage appropriate to the site and type of infection
- M Minimise duration of therapy
- E Ensure monotherapy in most situations

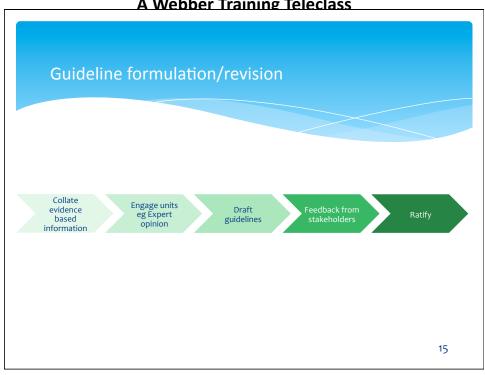
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# Persuasive AMS strategies: formulation of guidelines

- \* Based on national guidelines.
  - \* eg in Australia Therapeutic Guidelines: Antibiotic
- \* Local Guidelines may be adapted from these
  - \* Incorporating local susceptibility data eg hospital antibiograms
- \* Specialist unit protocols: eg Haematology, Transplant unit etc.
- \* Surgical prophylaxis
- "Consultant/specialist based protocols"

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# Vancomycin dosing and monitoring Guidelines Gentamicin usage Guidelines Community Acquired Pneumonia Guidelines Febrile Neutropenia Guidelines Surgical Prophylaxis Guidelines Epidural Abscess Management Pyelonephritis Guidelines Management of cellulitis

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## Persuasive AMS strategies: Post prescription review

- Review of antimicrobial prescriptions by an experienced assessor
  - \* eg Infectious Diseases physician, Clinical microbiologist, Pharmacist with experience in AMS/Infectious Diseases
- \* Some national consensus statements have recommended an 'AMT' Multi-disciplinary team consisting of an ID physician or clinical microbiologist/specialist ID pharmacist

Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. Dellit TH, Owens RC, McGowan JE et al. Clin Infect Dis 2007; 44: 159-77.

Antimicrobial Stewardship in Australian Hospitals. Duguid M, Cruickshank M. ACSQHC, Sydney; 2011. http://www.safetyandquality.gov.au/internet/safety/publishing.nsf/Content/
17 985EF00802E4E735CA25786A00223EAA/\$File/44471-Antimicrobial Stewardship\_2011.pdf

## Persuasive AMS strategies: Post prescription review

- \* Feedback directly to prescribers (preferably face-toface).
  - \* Provides a mechanism of dialogue with opportunity for 'academic detailing'
  - \* May lead to a reduction of unnecessary antimicrobial use

Academic detailing to improve use of broad-spectrum antibiotics at an academic medical center. Solomon DH, Van Houten L, Glynn RJ, Baden L, Curtis K, Schrager H, Avorn J. Arch Intern Med. 2001 Aug 13-27;161(15):1897-902.

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Antimicrobial 2 Start date: Indication:	:							
Antimicrobial 3 Start date: Indication:	:							
Antimicrobial 4 Start date: Indication:	:							
Antimicrobial 5 Start date: Indication:	:							
Creatinine / CrCL: Dosage adjustment needed: Microbiology Inw (Include sample type.	None :	Yes Yes	Recomme		erim	*RECOMMENDA 0 - CEASE ANTIN 1 - DECREASE CO 2 - INCREASE CO 3 - CHANGE DOS 4 - CHANGE THE 5 - SWITCH TO CO 6 - INVESTIGATIO	MICROBIAL OVER IVER SES RAPY DUE TO ORAL	D

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recommendations accepted by Cease antimicrobial Decrease spectrum of cover Increase spectrum of cover Change therapy due to safety	28% 24% 17% 5%	86% of

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## Restrictive AMS strategies: antimicrobial formulary

- \* Closed antimicrobial formulary that is regulated by a governing body --> eg Drugs and Therapeutics Committee
- \* Some antimicrobials are completely restricted and require pre-approval from expert group within the hospital eg Infectious Diseases Unit
- \* Others may have duration and/or indication restrictions (+/- exemptions)
- \* Should be well communicated to all prescribers and AMS stakeholders --> perhaps use visual queues

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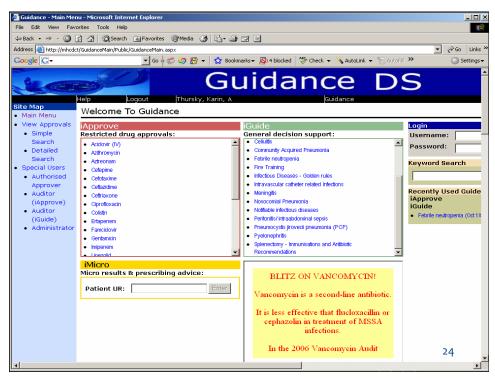
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## Restrictive AMS strategies: preapproval systems

- \* Surveillance
  - Concordant with Guidelines
- \* Education
  - Algorithm based advice
  - Linked to Local and National Guidelines
- \* Phone, Paper or Electronic based





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#### Hospital Antimicrobial Stewardship Programs

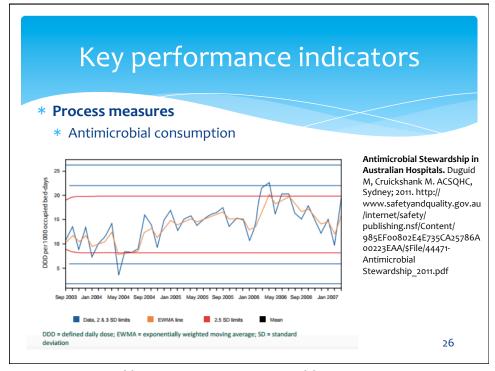
\* Cochrane Collaboration review supports 'restrictive' for immediate impact, however

Persuasive ≅ Restrictive

#### Time

- \* Diversity in AMS programs reported in literature
  - Hospitals adopt a combination of different types of strategies

Interventions to improve antibiotic prescribing practices for hospital inpatients. Davey P, Brown E, Charani E, et al. Cochrane Database Syst Rev 2013;(4)

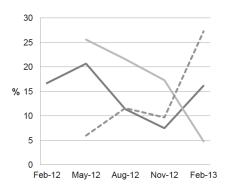


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## Key performance indicators

#### \* Process measures

\* Periodic point-prevalence surveys



Using periodic point-prevalence surveys to assess appropriateness of antimicrobial prescribing in Australian private hospitals.

Cotta MO, Robertson MS, Upjohn LM, Marshall C, Liew D, Buising KL. Intern Med J. 2014 Mar;44(3): 240-6.

Figure 1 Inappropriateness over time: treatment prescriptions. (——), Hospital A; (——), hospital B; (——), hospital C.

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## Key performance indicators

#### \* Structural indicators

- Can be a simple checklist and allow AMS personnel to ensure that 'the basics' of the stewardship program are in place
- \* Use validated indicators rather than reinventing!

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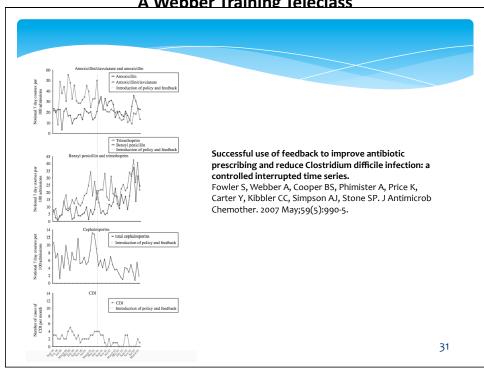
Performance of 14 Scott	ish AMTs	
against 10 European Validat	ed Indicators	
Formal mandate for hospital mutli-disciplinary     antimicrobial management team (AMT)	13	Development and validation of
AMT member is a member of Drug and Therapeutics     Committee	13	potential structure indicators t evaluating antimicrobial
Bedside expert consultant advice regarding antibiotics on request available the same day	13	stewardship programmes in European hospitals.
Regular ward rounds by members of AMT performed at least weekly	11	Buyle FM, Metz-Gercek S, Mechtler R, Kern WV, Robays H
Clinical audit of prescribers' compliance with local clinical guidelines by AMT	14	Vogelaers D, Struelens MJ; members of the Antibiotic
6. Antibiotic formulary/list updated biannually	14	Strategy International (ABS) Quality Indicators Team. Eur J (
<ol> <li>Local clinical practice guidelines for microbiologically documented therapy updated biannually*</li> </ol>		Microbiol Infect Dis. 2013 Sep; 32(9):1161-70.
8. Local clinical practice guidelines for empirical therapy updated biannually	14	
Local clinical practice guidelines for surgical prophylaxis     available	14	
10. Prescriber education by personalised interactive methods (e.g. daily ward rounds, face to face training sessions)	9	
		29

## Key performance indicators

- \* Outcome indicators
  - \* Perhaps the most difficult to quantify and attribute (given the potential confounders)

eg Hospital mortality, readmission rates and length of hospital stay may be too indirectly related to appropriate antimicrobial prescribing to be an accurate reflection of the performance of AMS programs.

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## AMS implementation plan for hospitals

\* Essential elements for AMS 'naïve' facilities

WHERE SHOULD THEY START??

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Establish sustainable governance structures through a dedicated committee that oversees AMS throughout the hospital (and is formally endorsed by hospital administrators).

Endorse a hospital-wide antimicrobial prescribing policy and ensure prescribers acknowledge their awareness of and commitment to these at the time of giving or renewing patient admitting rights.

Introduce a hospital-wide antimicrobial formulary that includes criteria for which antimicrobials may be prescribed and for what indication.

Recruit 'AMS champions' from core medical and surgical specialities and nursing groups who are leaders among their peers.

Nominate experts to provide individual pre- or post-prescription advice to ensure appropriate oversight.

Prioritise regular assessment of antimicrobial use. This will identify areas that may benefit from interventions, and assess the impact of implementing an AMS program.

Integrate nurses into the AMS program through targeted awareness campaign and provide education regarding their role.

Use multi-faceted education strategies for prescribers, pharmacists and nurses. Strategies should be both visual and electronic and suggestions include emails, webinars, online learning modules and face-to-face meetings.

Market the benefit of AMS in improving patient care to all health professionals in the hospital.

Antimicrobial Stewardship in Private Hospitals. Cotta MO, Buising KL. In Duguid & Cruickshank (Eds.) (In press):

Antimicrobial Stewardship in Australian Hospitals, 2nd Edition. Australian Commission on Safety and Quality in Healthcare. Sydney, Australia.

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# Thank you

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## Antimicrobial Stewardship Menino Osbert Cotta, University of Melbourne, Australia

A Webber Training Teleclass



#### October 29 AIR TRAVEL AND INFECTION TRANSMISSION

Dr. Paul Edelson, CDC JFK Quarantine Station, New York Sponsored by GOJO (www.gojo.com)

November 5 (Free Teleclass)

#### **DEMYSTIFYING THE CIC® CERTIFICATION EXAMINATION**

Roy Boukidjian, Northridge Hospital Medical Center Linda Goss, Nurse Practitioner, Global Health Center

#### November 12 SALMONELLA - TRENDS, PREVALENCE AND CONTROL

Prof. Keith Warriner, Guelph University, Canada

November 17 (FREE British Teleclass ... Denver Russell Memorial Teleclass Lecture)

#### THE ROLE OF WATER AS A VECTOR IN THE TRANSMISSION OF INFECTIONS IN HOSPITALS

Dr. Jimmy Walker, Public Health England, Biosafety Unit

#### November 19 CLOSTRIDIUM DIFFICILE INFECTION IN RURAL HOSPITALS

Dr. Nasia Safdar, University of Wisconsin

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